Kopp first proceeded to sketch the methods employed for determining the molecular and atomic weights of the elements. When an element can be volatilised conveniently, so that we can obtain its vapour-density, its molecular weight is readily decided. Those elements which enter with a large number of volatile, or gaseous bodies, like carbon, present but little difficulty. Those, like zinc, which form but one class of volatile compounds, leave much to be desired, for a series of homologous bodies are no better than a single member of the series. In this case, however, the specific heat of the element comes to our aid, and we can usually take such a multiple of its equivalent as will give, when multiplied by the specific heat, a product not far from six. Naumann's law also enables us to make use of the specific heat of salts as well as that of the elements, the product of the specific heat by the sum of the atomic weights being nearly equal for similar compounds, and usually six times that of the number of atoms in a molecule. But this fails in some cases, probably, because we cannot take the specific heat at a sufficiently high temperature, as in the case of ice. In many cases where the above tests fail, isomorphism holds good. But totally unlike bodies, containing an unlike number of atoms in the molecule, have the same crystalline form. To avoid this dilemma, Prof. Kopp proposes to limit the term isomorphous to those compounds which possess the same crystal-forming power, as proved by their ability to crystallise together, or, if unequal in solubility, the ability of one crystal to grow in a solution of the other. Both of these cases were beautifully illustrated by alums. If a trace of a chromalum solution be added to a solution of potash-alum, each crystal that forms will contain both, as shown by the reddish tinge, and the colour deepens as the quantity of chromalum added is increased. On the other hand, when a crystal of one sort of alum is placed in a solution of the other kind, it continues to grow. Fine specimens of such crystals were exhibited by the speaker, who is remarkably skilful in this matter of growing and nursing crystals. Many other isomorphous salts were exhibited, such as the sulphates of magnesia and nickel; in some cases two different salts had been deposited alternately over the crystal of a third salt. Most interesting were rhombohedra of calxspar covered with nitrate of sodium, thus proving these two bodies isomorphous. The professor acknowledged that he had had much difficulty in obtaining these, and had utterly failed to make a crystal of arragonite grow in a solution of nitrate of potash. Prof. Kopp said, in conclusion, that unlike number of atoms could not replace each other in a molecule of two isomorphous bodies. Sulphate of cadmium will crystallise with eight equivalents of water to three of the anhydrous salt. Sulphate of didymium crystallises with eight equivalents of water. Both have the same crystalline form, but two atoms of didymium seem to replace the three of cadmium:—

$$Di_2S_3O_{12} + 8H_2O;$$
$$Cd_3S_3O_{12} + 8H_2O.$$

But these salts will not crystallise together, and crystals of the latter, from a mixed solution, contain no pinkish tinge of didymium.

HER MAJESTY'S ASTRONOMER AT THE CAPE

MR. DAVID GILL has been gazetted successor to Mr. E. J. Stone in the direction of the Royal Observatory, Cape of Good Hope. The discrimination exercised by the First Lord of the Admiralty in this appointment, we are confident will be appreciated and applauded by astronomers generally. Obtaining his first experience in practical astronomy in the Observatory at Aberdeen, and in a private observatory which he erected in the same place, Mr. Gill was so fortunate as to be associated with Lord Lindsay in the designs and details of the large observatory founded by this nobleman at Dun Echt in 1870, taking the position of chief of the staff. He thus became engaged in the organisation of the expedition to the Mauritius fitted out by Lord Lindsay for the observation of the transit of Venus, on which occasion advantage was taken of the circumstance of a heliometer forming part of the equipment to determine the sun's distance by measures of the planet Juno, being the first trial of the method, and attended with satisfactory results; the details of this work were published by Lord Lindsay as the joint work of himself and Mr. Gill. In connection with the same expedition, Mr. Gill arranged and personally conducted the whole of the chronometric and telegraphic longitude determinations connecting Berlin, Malta, Alexandria, Suez, Aden, Bombay, Seychelles, Reunion, Mauritius, and Rodriguez. It was while engaged upon these operations that he undertook, at the request of the Khedive, the measurement of the first base line of the geodetic survey of Egypt. In 1877 Mr. Gill laid before the Royal Astronomical Society a proposal to determine the sun's distance by heliometric observations of the planet Mars about the very favourable opposition of that year, Lord Lindsay lending his heliometer for the purpose. The proposal met with the support of the Astronomer-Royal and Council of this Society, and was further aided in its execution by a grant from the government funds in the hands of the Royal Society. The Island of Ascension was fixed upon as a favourable station for these observations, and Mr. Gill proceeded to Ascension in June, being occupied there about six months in the necessary preparations and carrying out of the scheme. The reductions are still proceeding, but in proof of the importance attached to this attempt to obtain a reliable value of the solar parallax and the interest felt by the leading astronomers of different nations in his work, it may be mentioned that on asking for aid in the accurate determination of the positions of the stars observed with Mars, his request was cordially acceded to at the following observatories:—Greenwich, Oxford, and Liverpool, Albany, U.S., Berlin, Cambridge, Mass., Cordoba (the national establishment of the Argentine Republic), Königsberg, Leipsic, Leyden, Melbourne, Paris, Pulkova (the Imperial Observatory of Russia), and Washington.

We will express the hope that Mr. Gill may carry to his new sphere a continuance of the great energy he has hitherto shown and repeat our conviction that his nomination by the First Lord to the important position of "Her Majesty's Astronomer at the Cape," will be hailed with great satisfaction in the astronomical world. It is understood that Mr. Gill leaves England early in May, arriving at the Cape in good time to confer with Mr. Stone upon the future work of the Observatory.

OUR ASTRONOMICAL COLUMN

THE NAVAL OBSERVATORY, WASHINGTON.—The Report of Admiral Rodgers, superintendent of this great astronomical establishment, for the year 1878 has just been issued. The operations of the institution have been more than usually extended, involving expeditions for the observation of the transit of Mercury on May 8, and the total solar eclipse of July 29. The 26-inch refractor has been in charge of Prof. Asaph Hall, with Prof. Holden as assistant, and has been constantly employed in the observation of satellites, double stars, and nebulæ, and occasionally of comets. Admiral Rodgers mentions that many foreign astronomers visiting the United States on the occasion of the eclipse, took the opportunity of inspecting this instrument, expressing very generally an opinion that the mounting was too light, and in this opinion the superintendent to a certain degree coincides,

although it is pointed out that during the five years that the equatorial has been mounted, "the position of the pole of the instrument has changed only a fraction of a minute of arc." The observations of the satellites of Saturn refer mostly to Japetus, Hyperion, and Titan. The disappearance of the ring took place February 6; Bessel's elements were verified by observations of its angle of position on thirty-six nights by Prof. Hall, and on twenty nights by Prof. Holden. There are also observations of the satellites of Uranus and Neptune, besides the fine series on the two satellites of Mars which were placed in the hands of astronomers some time since. A good series of measures of the companion of Sirius was obtained, and the six stars in the trapezium of Orion have been measured in connection with observations of Mr. Otto Struve's selected list of stars for determining the personal errors of observers. Prof. Holden observed the Orion nebula on twenty-eight nights, also six others of the more interesting of this class of objects.

The transit-circle and the 9·6-inch equatorial have been in charge of Prof. Eastman; 3,450 observations were made with the former instrument during the year, while the equatorial has been occasionally employed for a very necessary auxiliary purpose when it is desired to observe the fainter or less accurately computed minor planets on the meridian, viz., in determining previously the approximate correction of the ephemerides; for want of this necessary preliminary observed at Washington, a considerable number of observations on the meridian have been put upon record as observations of faint minors, which have been found to belong to small stars, to the equal vexation of observers and computers.

During the transit of Mercury, seventy-two photographs of the planet upon the solar disk were made at Washington by Mr. Rogers, with one of the photoheliographs used for the transit of Venus. Prof. Harkness proceeded to Texas for the observation of this transit of Mercury, succeeding better with the later than the earlier half of the phenomenon. The compilation and discussion of the observations is proceeding under Prof. Eastman, and will soon be ready for publication.

With regard to the total solar eclipse, it is stated that the liberal appropriation authorised by Congress allowed of a number of separate expeditions being organised, and the co-operation of the leading astronomers of the United States was invited and cordially responded to; but, while the Observatory of Washington was enabled to assist in a financial point of view, the heads of expeditions were left free to arrange their own plan of observation. The report enters briefly into particulars of the stations and success of the observers, to which space will not allow further reference here. With respect to the search for an intra-Mercurial planet or planets, it is mentioned that the following, in addition to Prof. Watson, were so occupied, at least during a part of the time that the sun was obscured:—Prof. Asaph Hall at La Junta, Colorado, with a 5-inch Alvan Clark equatorial, power 150 diameters, sweeping south and following the sun to about 10° distance; Mr. O. B. Wheeler at the same place, with a similar instrument, sweeping below and preceding the sun; Prof. Newcomb at Separation, Wyoming, and Professors Holden and Pritchett at West Las Animas, Colorado, also conducted unsuccessful sweeps for an intra-Mercurial planet.

The Washington Observatory has made arrangements for dropping a time-ball in New York city, at noon daily, which took effect from September 10, 1877; there have been a few failures, the cause of which is explained. The volume of observations for 1875 was daily expected to be delivered from the press at the time the Report was drawn up: we presume there are few real astronomical workers who have not experience of the liberality with which the handsome volume annually issued has been distributed by the United States Naval Observatory.

TEMPEL'S COMET, 1867, II.—Since our last note referring to this comet, M. Gautier has published sweeping-ephemerides, in the calculation of which he first assumes the perihelion passage to occur May 10·9416 Berlin mean time (that being the epoch fixed by his calculations after taking into account the action of Jupiter during the present revolution, which has delayed the comet less than three days), and then varies this date by ∓ 4 days; he believes the error of his computation will not exceed these limits. The following are the positions taking T = May 10·9416 for midnight at Berlin, or roughly for 11h. Greenwich time, during the next period of absence of moonlight, or rather beyond it:—

1879.	Right Ascension.	North Polar Distance.	Log. Distance from Earth.	Intensity of Light.
	h. m. s.	° ′		
March 10	15 56 1	98 54·4	0·0960	0·188
,, 14	16 1 41	99 10·5	0·0808	—
,, 18	16 7 2	99 26·2	0·0657	—
,, 22	16 12 2	99 41·6	0·0506	—
,, 26	16 16 39	99 56·9	0·0355	—
,, 30	16 20 51	100 12·6	0·0206	0·278

An acceleration of four days in the time of arrival at perihelion will alter the comet's position on March 10, + 10m. 1s. in R.A., and + 1° 4′ in N.P.D.; and on March 30, + 11m. 51s. in R.A., and + 1° 11′ in N.P.D.

BIOLOGICAL NOTES

NEW FISHES FROM CENTRAL ASIA.—The last number of the *Bulletin* of the Imperial Academy of Sciences of St. Petersburg contains an interesting communication from Prof. Kessler on the fishes obtained by Prjvalsky during his recent expedition to Lob-Nor, a district previously unvisited by any naturalist. Herr Prjvalsky's collection from Lob-Nor and the basin of the Tarim contained examples of eleven species of fishes, eight of which belong to the family of *Cyprinidæ*, and three to that of *Cobitidæ*. As might have been expected, nearly the whole of these are new to science, and belong to genera (*Diptychus, Schizothorax*, &c.) characteristic of the high lands of Central Asia. One of the Cyprinoides is so peculiar as to necessitate the institution for it of a new genus, which Herr Kessler proposes to call *Aspiorhynchus*. *Aspiorhynchus prjvalskii*, as Prof. Kessler names this fish, in honour of its discoverer, inhabits the lower Tarim and Lob-Nor, where it attains a considerable size and furnishes an excellent article of food. Prof. Kessler suggests that two of the fishes obtained by the late Dr. Stoliczka during Forsyth's expedition to Yarkand, which were referred by Dr. Day to the genus *Ptychobarbus*, probably belong to his genus *Aspiorhynchus*.

DREDGING OPERATIONS, GULF OF MEXICO.—The last *Bulletin* (No. 9) of the Museum of Comparative Zoology at Harvard College, Cambridge, Mass., contains an account of some wonderful new or rare forms of echini, by A. Agassiz, of corals by L. F. de Pourtalés, and of ophiurans, by T. Lyman, all the specimens having been dredged, during the survey of the United States steamer *Blake*, in the Gulf of Mexico. Preceding the technical descriptions there is a bibliographical notice of the publications relating to the deep sea investigations carried on by the United States Coast Survey from 1850 to the present time. Of the echini described and figured in the present number is a most interesting new species of Dorocidaris (*D. blakei*). While the recent Cidaridæ, so far as at present known, do not by any means show the great variety in the form of their spines, which is found so common among the fossil genera of the family; yet here we have at least one species in which the variety of the shape of the spines is extreme. Its long tapering spines would have indicated its position in Dorocidaris, but its extraordinary flattened fan-shaped spines seem nearly identical with those of the Jurassic genus Rhabdocidaris—when